Part A: Slow Rate Land Treatment of Wastewater

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1. Preparing a Reuse Permit Application for Wastewater Land Treatment

A reclaimed wastewater reuse permit (reuse permit) is required to modify, operate, construct, or discharge to a reuse facility. The application of wastewater to land for treatment (wastewater land application) is one type of reuse. This section provides information on the process of applying for a *land treatment* reuse permit.

Note: Read this section if you are applying for a reuse permit application for the treatment of municipal or industrial wastewater by application to land.

If you are preparing a reuse permit application for other direct uses of municipal reclaimed wastewater—such as toilet flushing, dust control, or Class A wastewater treatment—see Part C, Section 12 of this guidance.

1.1 Required Information

The *Reuse Rules* (IDAPA 58.01.17) specify information required in a reuse permit application. In addition, application processing procedures are outlined in the reuse rules.

Other requirements for land application projects can be found in the following:

- Section 600 of the *Water Quality Standards and Wastewater Treatment Requirements Rules* (IDAPA 58.01.02) specifies requirements for the land application of wastewater (Note – this will be changed to *Wastewater Rules* (IDAPA 58.01.16) in 2006).
- The *Ground Water Quality Rule* (IDAPA 58.01.11) specifies necessary ground water quality requirements.

Applicants are strongly encouraged to review these rules to become familiar with these requirements (links to these rules are provided in the introduction to this document), before the pre-application form submittal and conference.

Note: See *Locations of the Rules*, in the Preface of this document, for information about locating the rules that apply to reuse.

1.2 Definitions

The following definitions apply to this section:

- *Major* permit modifications are those, which if granted, could result in an increased hazard to the environment or to the public health.

- *Minor* permit modifications are those, which if granted, would not result in any increased hazard to the environment or to the public health. Minor modifications are normally limited to the correction of typographical errors, transfer of ownership or operational control, or a change in monitoring or reporting frequency.

1.3 Steps in the Application Process

The three major steps in preparing a land treatment reuse permit application are listed below. These steps pertain to applying for a new permit, a renewal permit, a permit modification (minor or major), or to request a permit waiver.

1. Pre-application form submittal
2. Pre-application conference
3. Reuse permit application submittal.

Step 1. Pre-Application Form Submittal

The first step in preparing a reuse permit application is to submit the Reuse Permit Pre-Application Form and the Facility Basic Information Form, both of which can be downloaded from the following address:

http://www.deq.idaho.gov/Applications/WLAP/instructions.cfm

These Web-based forms should be completed and electronically submitted to a Water Quality Manager in the DEQ Regional Office in which the project is located. For a list of regional Water Quality Managers, see the following:

http://www.deq.state.id.us/about/regions/regional_managers.cfm#water

The Reuse Permit Pre-application Form should identify the type of application (new, renewal, major modification, minor modification, waiver request) and provide contact information. The Facility Basic Information Form is used to identify the types of waste, type of facility, types of reuse, approximate volume of wastewater, legal location, county, and description of the land application process.

By submitting these forms, the DEQ Regional Office is notified that the applicant is initiating the reuse permit application process.

Step 2. Pre-Application Conference

Before submitting a reuse permit application, it is highly recommended that a pre-application conference be held between the applicant and DEQ. For a new site, or if DEQ staff involved have not recently visited an existing site, consider scheduling a short site visit as part of the conference.

If you are applying for a minor permit modification or a permit waiver, contact the Regional DEQ Office to discuss your project prior to scheduling the pre-application

conference. It is possible that the detailed information outlined in the remainder of this section does not pertain to your situation.

If you are applying for a waiver, you should know that waivers from the requirements of the Reuse rules may be granted by DEQ on a case-by-case basis upon full demonstration by the applicant that:

- The waiver will not have a detrimental effect upon existing water quality, and uses are adequately protected, and
- The treatment requirements are unreasonable with current technology or economically prohibitive.

For all other types of reuse permit applications (new, renewal and major modification), the applicant and DEQ may consider the more detailed pre-application conference process presented below.

A. In preparation for the pre-application conference, it is recommended that *DEQ*:

1. Review the pre-application form submitted by the applicant.
2. If an existing site, and if time allows, review the permit file prior to the conference:
   a. Determine the status of compliance activities in the current permit.
   b. Review recent annual reports regarding: hydraulic and constituent loading rates, results of monitoring efforts, and other operating issues identified in the reports or through DEQ review of the reports.
   c. Review available site inspection reports.
   d. If applicable, review existing legal agreements, such as Consent Orders or a Notice of Violation (NOV).

B. In preparation for the pre-application conference, it is recommended that the *applicant* consult the "Suggested Outline for Preparing the Technical Report" and the "Guidelines for Preparing the Site Maps" (presented in Section 1.6), assemble as many materials and maps as is practical, and be as prepared as possible to discuss the items listed in the suggested outline.

Items recommended for discussion between the applicant and DEQ during the pre-application conference are listed below. For some applicants, the pre-application conference may be a preliminary inquiry and more than one conference may be necessary.

1. Have the applicant describe their proposal in detail.
2. Discuss scheduling issues:
   a. For a new site, discuss when the applicant proposes to begin land application activities.
   b. For an existing site, discuss the timeframe for any proposed changes to land application activities.
3. Discuss the ownership of the land application site. If not owned by the applicant, discuss the need for providing a lease or rental agreement.

4. Review the *Vicinity Ma*p and *Facility Site Map* (see Section 1.6) prepared for the pre-application conference. Discuss site topography, potential buffer zone issues, and other potential site constraints. Discuss what is recommended to be added to these maps for purposes of the reuse permit application submittal.
5. Review *Site Limitation Rating Criteria for Land-Applied Wastewater* (Table 2-1) and discuss site specific characteristics.
6. Discuss recommended sampling and analysis efforts to be performed for the purposes of preparing the reuse permit application. These efforts may include additional sampling of the land applied wastewater, site soils, site groundwater, and/or other sampling and analysis important for site characterization.
7. Discuss the need (and, if appropriate, a schedule) for seepage rate testing of wastewater structures or ponds.
8. Discuss local permits and approvals that may be required (conditional use permit, planning and zoning requirements, other agency approvals…).
9. Determine if the land application site will be leased or operated by a third party. If a third party is involved, a signed contract or agreement will be required regarding third party responsibilities for operating the site under the conditions of the permit.
10. For renewal permits, discuss if an updated Plan of Operation and/or updates of other site management plans should be submitted with the reuse permit application.
11. Review the *Suggested Outline for Preparing the Technical Report* section below and the materials assembled by the applicant for the pre-application conference. Discuss what additional information is recommended to be included with the Reuse permit application.
12. Discuss the overall steps and schedule for the permit process (refer to Section 1.8).

Step 3. Wastewater Reclamation and Reuse Permit Application Submittal

The reuse permit application submittal, at a minimum, should contain the items listed below.

- *Reuse Permit Application Form*: This form must be submitted with the signature of the owner or an authorized agent.
- *Technical Report* (suggested outline is presented below).
- *Site Maps* (described at the end of this section).
- *Plan of Operation Checklist*:
  - Existing facilities are required to have a plan of operation, which describes in detail the operation, maintenance, and management of the wastewater treatment system. An up-to-date Plan of Operation should be available for DEQ review as part of the reuse permit application.
  - For new facilities, a general outline of a plan of operation should be submitted.

1.4 Reuse Permit Application Form

A copy of the Application for Wastewater Reuse Permit can be found in the Appendix, Section A.12.

1.5 Suggested Outline for Preparing the Technical Report

A suggested outline for preparing the Technical Report is provided below. Depending upon the facility, the outline below may be reduced or, alternatively, expanded upon. For a renewal permit or a permit modification, the outline may be greatly reduced if previously submitted items are still representative of the applicant's activities.

I. Site Location and Ownership

A. Site Location

1. Describe the location of the wastewater treatment facility and, if different, the location of the land application site.
2. Describe relative locations of important land features (cities, roads…) to the treatment facility and land application site.
3. Describe adjacent land uses and identify distances from the boundary of the land application site(s) to the following buffer objects: dwellings, areas of public access, canals/ditches, private water sources, and public water sources.

B. Site Ownership

1. Identify who owns the land application site. If not owned by the applicant, describe any pertinent leases or agreements in place.
2. Within this section, or referring to an appendix, provide the following documentation:
   a. Land Application Site Ownership: provide documentation of site ownership for areas of land application.
   b. If the applicant is leasing or renting the land application site, provide an affidavit stating the specifics of the water use agreement or lease stating the actual control over the property.
   c. Provide copies of any other agreements affecting the ownership and/or operation of the site (right-of-way easements, for example).
   d. List all local, state, and federal permits/licenses/approvals related to the land application facility. For each, list the date(s) of application, the current status, and, if applicable, the approval date. Include any required planning and zoning approvals and/or required conditional use permits.

II. Process Description

A. Process Flow Description

1. Identify the sources of wastewater. Describe any seasonal variations in the wastewater (quantity and quality).
2. Describe the flow path of wastewater from the wastewater source to the land application site.
3. Identify the major treatment steps (equipment) of the wastewater treatment facility. For municipal systems, describe the disinfection treatment system and the proposed level of disinfection.
4. Identify sizes and design capacities of major equipment.
5. Identify the flow design basis. For existing sites, present recent wastewater flow data.
6. If applicable, describe any alternate treatment methods being considered.
7. Describe procedures that would be followed if the principal wastewater treatment procedures could not be used temporarily.
8. Identify sources and types of generated waste solids.

B. Land Application Site

1. Identify the number of land application acres.
    a. If applying for a new permit, identify the proposed number of land application acres.
    b. If applying for a renewal permit or permit modification: 1) list the current hydraulic management units and associated acres and 2) describe any proposed changes to the land application acreage.
2. Identify the type(s) of irrigation system(s) (pivot, hand lines,…) and the corresponding irrigation efficiency(ies).

III. Site Characteristics

A. Site Management History

1. Describe past and current uses and management of the land application site including: important events and dates, cropping information, historic fertilizer use, and other key past and current site management information.

B. Climatic Characteristics

1. Describe the climatic characteristics of the site including precipitation data, high and low temperature data, frost free days, growing degree days, and prevailing wind direction.

C. Soils

1. Describe site soils. Present Natural Resource Conservation Service (or similar) soil survey information and results of any on-site investigations.
2. Present and interpret available soil monitoring results.
3. If wastewater land application in the non-growing season is proposed, calculate and present the available water holding capacity of the soils.

D. Surface Water

1. Identify and describe the location of surface water(s) near the land application site.
2. As applicable, discuss canals, wetlands, springs, floodplains, and other surface water related site characteristics including beneficial uses.
3. Describe, as appropriate, the influence of site land application activities on nearby surface water(s).

E. Groundwater/Hydrogeology

1. Describe the groundwater system, including: depth to first water, depth to regional groundwater, confined or unconfined (if known), flow direction (if known), and seasonal depth and flow direction variations. If applicable, describe the presence of a major aquifer.
2. Discuss the locations and uses of wells (public wells, private wells, monitoring wells, and injections wells) within ¼ mile of the land application site. Include copies of well logs, if available. The IDWR (Idaho Department of Water Resources, www.idwr.state.id.us) may be contacted for assistance.
3. If a Well Location Acceptability Analysis has been performed for the site, present and interpret results of the analysis.
4. Present and interpret available groundwater monitoring results (upgradient and downgradient of the land application site) and/or on-site investigations.
5. Present and interpret results of any groundwater modeling efforts for the site.

IV. Wastewater Characterization, Cropping Plan, and Loading Rates

A. Wastewater Characterization

1. Identify the quantity of land applied wastewater (per day, per month, per year). Document how the quantity values were determined.

2. Characterize the concentrations of key constituents in the wastewater proposed for land application. Document how the concentration values were determined. Basic constituents of interest are: total nitrogen, total phosphorus, and Chemical Oxygen Demand (COD). Depending on the wastewater source, concentrations of other constituents may be important. For industrial systems, concentrations of total dissolved inorganic solids (TDIS) and/or metals may be pertinent. For municipal systems, total coliform counts may be presented.

B. Cropping Plan

1. Describe proposed crop selection and a 5-year rotation plan.
    a. For each crop, describe: planting and harvesting data, irrigation sensitivity, rooting depth, expected yield (compare to yield data published by the Idaho Department of Agriculture (see Section 7), and expected crop uptake values for key constituents in the wastewater.
    b. For each crop, calculate and present the Irrigation Water Requirement (IWR). Document how the IWR value(s) were determined.
    c. If proposing to utilize wastewater for tree irrigation, present a silvicultural plan (a plan covering the care and cultivation of the trees).
2. Describe the proposed future use of fertilizers at the site. Document nutrient loading associated with fertilizer use.

C. Hydraulic Loading Rate

1. Present the expected wastewater hydraulic loading rates by month for growing season and non-growing season.
2. Describe the availability of supplemental irrigation water for the site and whether or not supplemental irrigation water is expected to be used at the site. Provide documentation that water rights exist to provide supplemental irrigation. If expected to be used, present the typical supplemental irrigation water hydraulic loading rates for potential crops.
3. Discuss irrigation scheduling for the site.
4. If storage of wastewater is proposed, prepare and present a monthly water balance for the storage structure(s) reflecting: number of days of storage, required freeboard, minimum depth, evaporation, precipitation, and flows into and out of the structure.

D. Constituent Loading Rates

1. Calculate and present the expected growing season and non-growing season loading rates for key constituents. If waste solids and/or fertilizers are proposed to be applied to the land application site, reflect the application of these materials in site constituent loading rate calculations.
2. Compare expected constituent loading rates to applicable crop uptake values for the site.
3. Identify the design limiting constituent.

V. Site Management

A. Compliance Activities

1. If applying for a permit modification or a renewal permit, provide a summary and status of compliance activities under the existing permit.

B. Seepage Rate Testing

1. Discuss the need (and, if appropriate, a schedule) for seepage rate testing of wastewater structures or ponds.

C. Site Management Plans

If the site has previously developed any of management plans listed below (or other site specific plans), either separately or as part of the site Plan of Operation, provide any updates to the information presented in the plan(s). If a new site, or if the plans have not been developed for an existing site, address each of the plan topics.

1. *Buffer Zone Plan*:
   a. Discuss disinfection and buffer zone issues for the land application site. Address the following buffer objects: dwellings, areas of public access, canals/ditches, private water sources, and public water sources.
   b. Compare site buffer distances to DEQ guideline buffer distances. As applicable, describe any proposed mitigation measures to potentially reduce the required buffer distances.
   c. Describe current and/or proposed fencing and signing for the facility.
2. *Grazing Management Plan*: required if any grazing activities are proposed at the land application site.
3. *Nuisance Odor Management Plan*: for systems with higher strength wastewater (wastewater with a greater potential to create odors), it is highly recommended that a Nuisance Odor Management Plan be prepared as part of the permit application.
4. *Waste Solids Management Plan*: discuss whether or not solids are to be applied on the permitted reuse site. If so, reflect the application of waste solids in site constituent loading rate calculations. If waste solids are managed off-site, refer to IDAPA 58.01.02, Section 650 regarding sludge usage.
5. *TDIS (Total Dissolved Inorganic Solids) Management Plan*: to address potential increases in TDS (total dissolved solids) concentrations in groundwater and/or excessive salt levels in soils.
6. *Runoff Management Plan*: to address best management practices for minimization of runoff and ponding.

D. Monitoring

1. Describe how the quantity of land applied wastewater is proposed to be monitored (methodology, frequency, location).
2. Describe proposed sampling and analysis of the land applied wastewater (constituents, disinfection level, methodology, frequency, location).
3. Describe method of calculating hydraulic and constituent loading.
4. If supplemental irrigation water is expected to be used, describe how the quantity of land applied supplemental irrigation water is proposed to be monitored (methodology, frequency, location).
5. Describe proposed soil monitoring (constituents, soil depths, methodology, frequency, location).
6. Describe proposed groundwater monitoring (constituents, methodology, frequency, location).
7. Describe how crop uptake values are proposed to be determined (plant tissue monitoring, table values…).
8. Describe other proposed monitoring for the site.
9. Describe meteorological monitoring for site.

E. Site Operations and Maintenance

1. Describe who will operate and maintain the wastewater treatment facilities and land application site.

2. Describe operator certification credentials—credentials currently held and any plans for future certifications.
3. If a party other than the applicant operates and maintains the land application site, submit a copy of the signed contract or agreement outlining how the site will be operated to meet the conditions of the permit.

1.6 Guidelines for Preparing the Site Maps

If helpful for ease of preparation and/or use, the information listed under Vicinity Map and Facility Site Map may be divided between more than two maps. The maps may be included as an appendix in the technical report.

1.6.1 Vicinity Map

The Vicinity Map is a topographic map, extending one quarter (1/4) mile beyond the outer limits of the facility site. As required in the *Reuse Rules* (IDAPA 58.01.17), identify and show the location and extent of the following:

- Property boundaries of all treatment facilities and land application area(s). Include Township(s), Range(s), Section(s).
- Wells, springs, wetlands, and surface waters.
- Public and private drinking water supply sources and source water assessment areas (public water system protection area information).
- Public roads.
- Dwellings and private and public gathering places.

1.6.2 Facility Site Map

The *Facility Site Map* is a topographic map. As required in the *Reuse Rules* (IDAPA 58.01.17), identify and show the location and extent of the following:

- Wastewater inlets, outlets, and storage structures and facilities.
- Wells, springs, wetlands, and surface waters.
- Twenty-five (25), fifty (50), and one hundred (100) year flood plains, as available through the Federal Insurance Administration of the Federal Emergency Management Agency.
- Service roads.
- Natural or man-made features necessary for treatment.
- Buildings and structures.
- Process chemicals and residue storage facilities.

In addition, the following items are recommended to be identified on the Facility Site Map:

- Land application area(s).
  - For an existing site, identify the permitted hydraulic management units, including serial number, and clearly show any proposed changes to the land application acreage.
  - For an existing site, identify the soil monitoring units, including serial number.
- For an existing site, include serial numbers for lagoons/storage ponds (if applicable).
- Wastewater and site monitoring points, including groundwater monitoring wells (if applicable).
- Quantify and label buffer zone distances between the land application area(s) and: dwellings, areas of public access, canals/ditches, private water sources, and public water sources.

1.6.3 Other Site Specific Maps and Drawings

Present other pertinent maps or drawings for the site. These may include:

- Groundwater contours and direction of flow.
- Wastewater treatment facility drawings.
- Irrigation system design drawings showing sumps, pipelines, ditches, irrigation diversions, irrigation systems (pivots, wheel lines, etc.), and other relevant items.
- Location and extent of run-on and/or run-off control systems including berms and tailwater collection systems.
- Other maps important for presenting site characteristics and/or site operations.

1.7 Plan of Operation Checklist

A copy of the Plan of Operation Checklist can be found in the Appendix, Section A.12.

1.8 Reuse Permit, Permit Process Steps

Procedures and timing for processing reuse permit applications are outlined in the *Reuse Rules* (IDAPA 58.01.17). Applicants are encouraged to review the rules to become familiar with these procedures. (See the Preface to this guidance for links to the rules affecting reuse.)

1.8.1 Typical Steps for a Reuse Permit

Typical steps associated with obtaining a reuse permit from DEQ are as follows:

Pre-application form submitted to the DEQ Regional Office.

4. Pre-application conference between the applicant and DEQ.

5. Applicant submits a reuse permit application to the DEQ Regional Office.
6. DEQ performs a completeness review. Typically, at this step, DEQ also makes a preliminary decision regarding whether or not to issue a permit.
7. DEQ prepares a *Staff Analysis* and *Draft Permit* for the complete application.
8. DEQ issues a draft permit. This step includes review of the draft permit and staff analysis by DEQ's state program office and the DEQ Director. The draft permit and staff analysis are posted on the DEQ internet site.
9. Comments may be submitted by the applicant and by the public. In some cases, meetings are held between DEQ and the applicant to discuss the draft permit. Also, if appropriate, public information meetings may be held.
10. DEQ prepares responses to comments and prepares the final permit. If substantial modifications are made to the permit, they are reviewed with the DEQ Director.
11. DEQ issues final permit. The applicant may appeal the final permit, if desired.

1.8.2 Reuse Permit Application Timing

The reuse rules specify the following timing for submitting a reuse permit application:

- At least one hundred eighty (180) days prior to the day on which a new activity is to begin;
- At least one hundred eighty (180) days prior to the expiration of any permit issued pursuant to these rules;

To meet this requirement, applicants are encouraged to plan ahead. Some applicants may need to allow six months or more for preparing the permit application *prior* to submittal. Examples for which additional time may be required include the following:

- Applying for a new permit.
- Applying for a major permit modification.
- Applying for a renewal permit when major changes to land application activities are to be addressed with the renewal permit.

If you are applying for a minor permit modification, discuss the scope and timing of the modification application with the DEQ Regional Office. For example, it may not be possible to foresee a transfer of ownership 180 days prior to the change. Requests for changes in the permit processing procedure are addressed by DEQ on a case-by-case basis.

For guidance on preparing a *Reuse Permit Application* for the other uses of municipal reclaimed wastewater that do not involve land treatment, see Part C of this Guidance.

1.9 Reuse Permit Templates

Permit templates used by DEQ, for both municipal and industrial reuse applications, are provided in the Appendix, Section A.11.

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2. Site Evaluation, Selection, and Management

When considering the use of land to treat wastewater, a number of concepts should be considered. The soil crop system must be used to treat the wastewater to prevent problems related to ground and surface water pollution and nuisance situations. The use of land for disposal only of the wastewater generated from a facility is not acceptable. Land based systems must be evaluated as a treatment, not disposal mechanism. Every effort should be made to apply wastewater at a rate and manner that will allow the soil crop system to assimilate the wastewater constituents such that minimal amounts leave the site through leaching or runoff.

The physical characteristics of a proposed wastewater treatment site must be evaluated as part of the site selection screening process. This process must keep in mind the characteristics and volume of the wastewater. These considerations will help determine the limiting factors associated with the proposed site.

This section provides numerical guidelines for site evaluations for environmental, management, and sociological factors where possible. It should be noted that exceptions can be made in many cases but the wastewater generator must supply adequate information to establish a reasonable operation plan. It is the intention of DEQ to work with the wastewater generator to meet their needs in a reasonable way while still protecting the waters of the state.

2.1 Environmental Factors

Initial site evaluation is an important step in determining the potential an area might have for the treatment of wastewater. This general investigation can provide good background for further evaluation and prevent possible costly detailed site reviews. Environmental factors to evaluate include climate, soils, topography, geology and hydrogeology. A detailed discussion of the needs of the soil crop treatment system is included in these guidelines and can also be helpful in initial site evaluation.

2.1.1 Climate

Idaho has a wide range of climates which affect temperature, growing season and evapotranspiration. These climatic factors may determine, to a greater or lesser extent, crop or vegetation to be used on site, the amount of storage which may be necessary for wastewater, and the amount of natural precipitation that must be considered for site and system design. These climatic factors also help determine evapotranspiration and evaporation rates during each season and management considerations for operation and maintenance of the site.

A site evaluation includes obtaining specific information related to local temperature ranges to determine the growing season and trends in precipitation levels. The necessary considerations related to temperature are the length of the growing season and the period of freezing conditions. Low temperatures affect the capacity of the soil crop system to

effectively treat wastewater during the winter months and must be evaluated on a case-by-case basis. Temperatures range from an average of 53 degrees F in the Boise area to less than 44 degrees F in the mountains including the higher mountain valleys. The growing season, where temperatures remain above 32 degrees F, can range from 135-165 days in the Boise area to less than 80 days in high mountain regions. The evaporation rate from open water ranges from 40 inches in southern Idaho to 26 inches in some of the high valleys during the growing season.

The levels of precipitation in Idaho range from 6 inches to nearly 80 inches in some higher mountain areas of the northern part of the state. It should be recognized that in Idaho the precipitation is generally highest when temperatures are at their lowest, but in most cases, precipitation in Idaho is low.

Analysis of rainfall data should be conducted in terms of quantity and seasonal distribution. Types of precipitation data usually required for site suitability considerations for wastewater application and treatment include: total mean annual precipitation, maximum annual precipitation, mean monthly precipitation, maximum ten year storm event, and the effects of snow on year round application systems.

Other climatic factors that may be considered in site selection are prevailing winds and wind velocity. The prevailing winds can have an important effect on site selection (see Section 2.1.2 below) See Section 4 for further discussion of precipitation with respect to crop needs and hydraulic loading.

2.1.2 Soil

Idaho has a wide range of climates, geologic, topographic and natural biological conditions that affect the kind of soil that is formed. There are almost 1,000 different kinds of soil in Idaho. Soils differ in their response to use and management, are unique to positions in the landscape and may be different over a short distance.

The solid matrix of soils consists of sand, silt, clay and organic matter. Because of their small relative surface area, the sand and silt elements are essentially nonreactive. These soil textures provide a relatively rigid framework containing the clay and organic matter but by themselves function largely as a physical filter. On the other hand, the clays and organic elements of the soil matrix are extremely reactive, thus determining the treat ability of wastewater by soils.

For general site evaluation, published or unpublished soil surveys are useful. Published soil surveys are usually made under the leadership of the Soil Conservation Service, and are available through the Soil Conservation Service, Extension Office, Soil Conservation Districts, or the BLM District Office. Unpublished mapped areas may be available through the local office of the Soil Conservation Services or the BLM District Office. For the land that is under the jurisdiction of the USDA Forest Service, soils maps may be available through the local Forest Service Office. The General Soil Maps for Idaho, 1984, are also useful for potential site location.

On-site soils descriptions and investigations should be made of sites that have been selected. The description should be made by a soil scientist, preferably a Certified Professional Soil Scientist. The soil description should include information to determine

the suitability of the soil to adequately treat the wastewater. The characteristics of wastewater will dictate the kinds of soil characteristics that will be required. Sometimes it is useful to have the soil classified according to *soil taxonomy* (USDA-SCS, 1984).

Typically the description should include: texture of different horizons, estimated organic matter of the surface and in some cases subsurface horizons, horizon thickness, color, structure and pH. Nutrient status of the soil, including plant available nitrogen and phosphorus, is also important. Other factors include depth and characteristics of the underlying bedrock or limiting layer, natural soil drainage, permeability of the least permeable layer, depth to seasonal water table, and soil slopes. Descriptions of other soil characteristics may be needed like infiltration rate, cation exchange capacity, kind of clay, available water capacity, kind and amount of coarse fragments, soil temperature and moisture regimes, salinity, sodium adsorption ratio, flooding potential, soil erodibility factors, wind erodibility factors, coatings of oxides, sesquioxides, zones of carbonate accumulation, and for loose sand and gravel the percent of different sizes of the fractions. The importance of these descriptions will depend on the characteristics of the wastewater which is to be treated.

There are many factors related to the above discussions important to land treatment of wastewater. The table below gives a physical characteristic rating for the potential suitability of a site for wastewater treatment. These characteristics need to be evaluated when considering a site for wastewater application. There are some characteristics not listed that may need evaluation for some unique kinds of a rating of very severe in any of the major factors in the Table 2-1 may make the site unacceptable unless it can be reasonably shown that it will not create any significant environmental impact. The rating of severe does not mean that a potential site is not usable, but may be one of the limiting characteristics, when combined with others, may make the site unusable. On the other hand, a rating of slight does not mean that a site will function properly if other site conditions are severe or the system is mismanaged.

The rationale for criteria of particular importance in the table below are discussed here. Sites that have limiting layers or consolidated bedrock at less than five feet have a potential for hydraulic overloading when high volumes of water are applied. The high salt content of the soil in relation to that of the wastewater can limit treatment and be detrimental to the hydraulic conductivity of the soil. Sites with steep slopes have an increased potential for runoff and erosion which may cause off site damage. Slope will affect the type of application system and site management.

Sites with cryic (cold) soils have a shorter season of use and the biological activity of these soils is lower during the cold season affecting the efficiency of wastewater treatment. Sites with short frost free seasons have a shorter period of use and may indicate a need for storage or larger area for application during cold months.

Sites with soils containing carbonates, oxides and certain sesquioxides will more readily fix phosphates, and heavy metals. Heavy metals are less mobile in soils within a pH range of 5.6 to 7.9 and generally mobilize in soils with a pH value of 5.6 and below. Soils that contain high volumes of coarse fragments have less reactive surface area for wastewater treatment. Application areas may need to be designed larger to adequately treat the wastewater.

Sites with surface textures of sandy loam, slit loam and loam have better tillage characteristics than soils with higher clay contents. Site management is more critical for sites with high clay content. Also infiltration and permeability rates decrease as clay content increases. Sites with soils that have too rapid or too slow permeability (see the table below) have lower wastewater treatment potential. Soils with rapid permeability can allow wastes to travel through the root zone without adequate treatment. Those that have slow permeability will increase the size of the area needed to prevent hydraulic overloading.

Maintenance of the soil organic matter is important in that it provides a host of soil microbes, has exchange complexes to hold pollutants, and aids in maintaining good soil physical conditions. See Section 7 for further discussion on soils.

Table 2-1. Site Limitations Rating Criteria for Land-Applied Wastewater.

Site Characteristics	Very Severe	Severe	Moderate	Slight
AWC in/60 in. (Available Water Capacity	<1"	1 - 3"	3 - 6"	>6"
Bedrock Characteristics if >5' depth		Highly Fractured Columnar	Fractures 1 - 2' apart	Fractures >2' apart
Cation Exchange Capacity (Surface 10")	<5 meq/100gr	5 - 10 meq/100gr	10 - 20 meq/100gr	>20 meq/100gr
Coarse Fragment (>3") (0-40" depth)	>60%	35 - 60%	15 - 35%	<15%
Depth of Bedrock	<2'	2 - 3'	3 - 5'	>5'
Drainage Class	Very Poorly Excessive	Poorly Somewhat Poorly Somewhat Excessive	Moderately Well	Well
Erodibility (Water) K Factor X slope	>6	4 - 6	2 - 4	<2
Flooding Potential	More than once per year	Every 1 - 2 years	Every 2 – 5 years	> Every 5 years (none)
Frost Free Season[2] (32 F)	<60 days	60 - 90 days	90 – 120 days	>120 days
Limiting Layer Depth (duripan) (fragipan)	<3'	3 – 4'	4 - 5'	>5'
Organic Matter (0-10" depth)	<0.5%	0.5 - 1%	1 – 3%	>3%
Permeability (Slowest layer within 5' depth)	>20" per/hr <0.06" per/hr	10 - 20" per/hr 0.06 - 0.2" per/hr	6 - 10" per/hr 0.2 - 0.6" per/hr	0.6 - 6" per/hr
pH 0-40" depth	<4 >9	4.0 - 4.5 8.5 - 9.0	4.5 - 5.6 7.9 - 8.5	5.6 - 7.9
Salinity 0 - 40-" depth	>8 mmhos/cm	4 – 8 mmhos/cm	2 - 4 mmhos/cm	<2 mmhos/cm
SAR (Sodium Adsorption	>12	8 - 12	4 - 8	<4

Site Characteristics	Very Severe	Severe	Moderate	Slight
Ratio)				
Slopes %[1]	>12	6 - 12	2 - 6	<2
Soil Texture Surface	Clays >50% Extremely Gravelly Textures, Stony Soils, Very & Extremely Cobbly	Clays, Silty Clays, Cobbly Soils, Very Gravelly Textures	Silty Clay Loams, Clay Loams, Gravelly Textures, Sandy Clay Loam, Sands	Sandy Loams Silt Loams Loams
Soil Temperature Regime			Cryic	Frigid or warmer
Soil Moisture Regime		Aquic	Aquic Intergrade	Xeric Udic Aridic
Subsurface Structure 3-24" depth		Massive Platy Columnar	Weak Blocky Weak Prismatic	Mod & Strong Blocky Mod & Strong Prismatic
Surface Structure 0-10" depth cultivated 0-3" depth, native		Cloddy Massive Platy	Weak Granular Weak Blocky	Mod & Strong Granular, Mod & Strong Blocky
Water Table Depth	<2'	2 - 3'	3 - 5'	>5'
Wind Erodibility Group (SCS)		6, 7, 8	1, 2	3, 4, 4, <5

[1] Land that is established in forests can be acceptable in the very severe range.
[2] Summer application can be considered if classified very severe.

2.1.3 Topography

The topography of the site is also important to the site selection and management. The more level topography present, the fewer difficulties in the construction, operation and maintenance of a land treatment system. Potential land treatment sites which have a slope of less than 2% are considered to be the most suitable. As slope increases so does the potential for erosion and runoff. It also is harder to evenly distribute the wastewater. Sites with slopes above 8% are severely limited and may not be acceptable for wastewater application without special care in both design and operation. Erosion and runoff potential increases as slope of the site increases.

Southerly and westerly slopes receive higher amounts of solar energy. Plants start growing earlier in the spring and have a potential of less frost damage from light frosts in the spring and fall. Sites in low pockets with higher adjacent areas may have a higher potential for cold air accumulation and potential frost damage. North and east slopes usually accumulate more snow. Snow accumulations on these positions last longer and

result in somewhat shorter growing season. Toe slope positions accumulate water from higher elevation and potentially have higher moisture and possible high water tables.

2.1.4 Geology and Hydrogeology

The geologic factors are important in evaluating a site for land application of wastewater since the treated or partially treated wastewater that moves beyond the soil column will enter the underlying geologic zone and ground water. Figure 2-1 shows aquifer types in Idaho.

The degree to which a given lithologic unit acts as a barrier (aquiclude) or transmitter (aquifer) depends on its porosity and permeability. Fracturing due to rapid contraction at the surface while cooling is characteristic of igneous rocks and generally of high water yielding formations such as the Snake Plain Aquifer. Any geologic unit which may be a source of drinking water or for uses requiring high quality ground water will have to be evaluated carefully to understand the potential contamination problems that could result. For example, the nature of the bedrock beneath the land treatment site should be evaluated if the soils are shallow or don't have the necessary textural qualities.

Geologic factors of the site that should be considered include the characteristics of the ground water including depths, kinds (confined or unconfined), flow direction, rate of flow and quality of water. The presence or absence of a major aquifer should also be considered. Depth to and thickness of limiting layers may effect the usefulness of the site as they affect the mounding potential of water below the site. Bedrock depth, kind and characteristics (i.e., fractured, weathered, solid, dense, tilt or slope) of underlying unconsolidated material (including sediments, alluvium, gravel and sand) should also be considered, along with any other characteristics of the vadose zone that effect movement of water. The potential for ground water contamination is greater if a site has highly fractured bedrock at less than five feet. The potential for contamination is greater in sites with water tables at less than five feet. See Section 7 for further discussion of ground water.

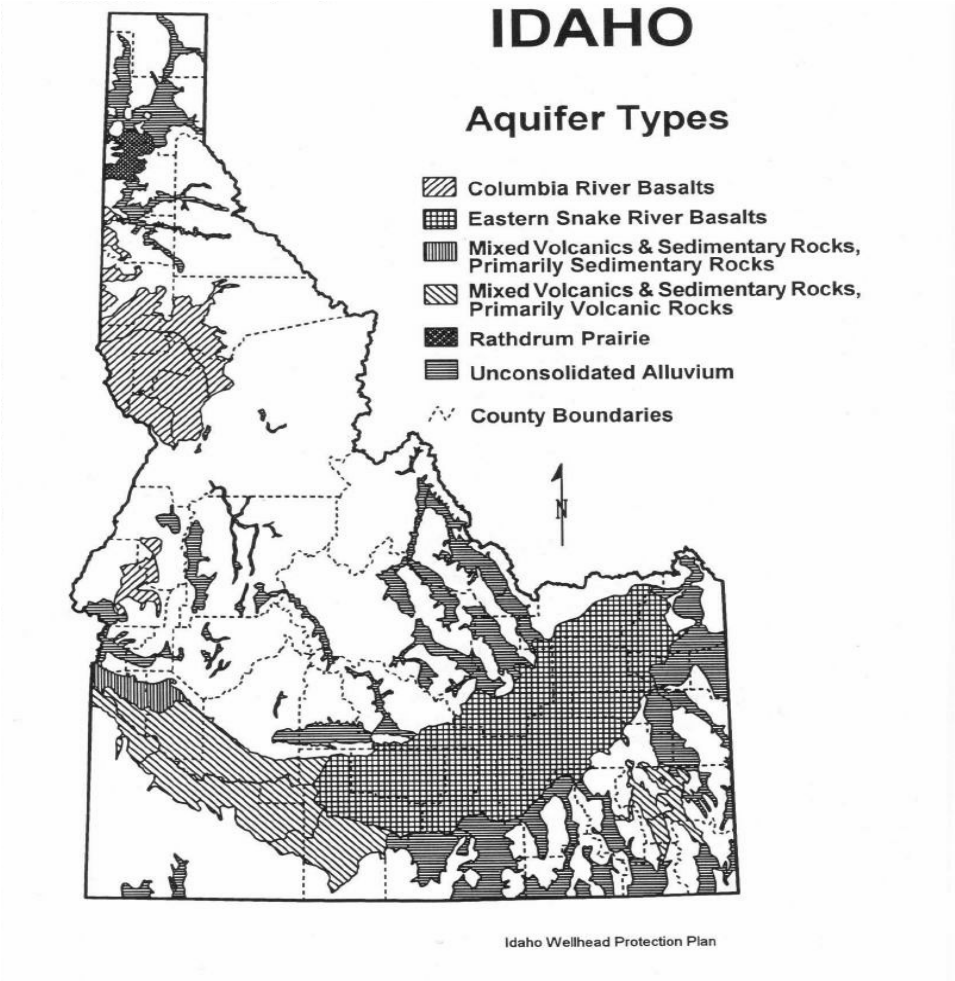

Figure 2-1. Map of Major Aquifers in Idaho.

2.2 Wastewater Characteristics

Constituent and hydraulic loading considerations are important to the evaluation of a site for land application of wastewater. Any one of these factors can be potentially limiting depending on other site characteristics. Several factors should be considered to determine if land-application can be used as a wastewater treatment method. Detailed discussions of constituent loading are found in Section 4.

2.3 Crop Management

The science of site management can be very complex. The operator must be well qualified and take in consideration the waste materials, soil site conditions, climatic conditions, vegetation management and economics. Site management may be the most critical link in the overall operation of the facility. An individual site can have the best soils and a proper design, but will likely fail if adequate site management is not practiced. This will require a procedure to periodically review and update the management plan.

The establishment and maintenance of the vegetation cover and crop is important. In order to reuse and remove nutrients applied from wastewater land treatment, the crop must be harvested and removed from the treatment site. Harvesting operations should be conducted when soil moisture conditions are below field capacity. If a site is mismanaged and the vegetation dies, the site will not be as effective in treating the wastewater. Plant or crop selection is very important in the operation plan. However, if the wastewater characteristics change from the original plan there may be a need to change the plant or crop. Over application of N can cause accumulation of nitrate in plant tissue. Cattle poisoning can result from feeding forages with levels exceeding about 2,000 ppm nitrate as N.

Some sites do not remove all harvested material and may need additional consideration of nutrient losses. This is particularly important with silvicultural sites where significant nutrients are returned to the system if slash is not removed at harvest time. Silvicultural plans (or plan updates) for forest/tree sites are required at approximately five-year intervals. These plans should be prepared by a qualified silviculturist and describe necessary management techniques and recommend harvest cycles. Plans should include the following items: 1. Use of long-term, forest management principles; 2. Minimization of surface water flow by proper irrigation scheduling and maintaining vegetative cover. 3. Maintenance or enhancement of water quality; 4. Maximization of productivity of the forest resource, and 5. Protection of the forest resource from insect, disease, and fire hazards. These items for inclusion are taken from the Garfield Bay Forest Management Plan prepared by Inland Forest Management, Inc. in 1995.

2.4 Sociological Factors and Land Use

Sociological factors must be taken into account when evaluating suitability of wastewater land application proposals. Planning and zoning is discussed as well as considerations relating especially to nuisance conditions.

2.4.1 Planning and Zoning Requirements

Chapter 65, Title 67, Idaho Code grants authority for comprehensive land use planning to local government. Contact the local city or county Planning and Zoning (P&Z) authority for zoning permits, conditional use permits and building permits; flood plain and storm water run-off requirements; and other types of planning requirements such as landscaping requirements for both new, expansions or remodels to existing facilities. Some P&Z departments may require a conditional use permit for the wastewater-land application system separate from the facility's zoning permit for the site. Some P&Z authorities may also act as the coordinator for approvals coming in from various agency inspectors on such issues as plumbing, electrical and fire codes.

An evaluation of the surrounding land uses must take place as part of determining the acceptability of the site by the community. The present land use should be evaluated in site selection. The planned use of the site should not conflict with the present or planned uses of adjacent property. Land uses that need to be considered in site evaluation include proximity of municipal wells and wells for domestic use, proximity of homes, and proximity of other installations and industry that have the potential for impacts on ground water or air quality such as landfills.

Direction from potential conflicting land uses is an important land use consideration. It may not be suitable for a wastewater land application facility to be located upwind from an urban area, or up gradient of a municipal well. See both Sections 6.6 (*Protection of Domestic and Public Well Water Supplies*) and 6.6.3.1 (*Well Location Acceptability Analyses*) for additional information. See also DEQ Policy Memorandum PMOO-6, *Policy for Responding to Odor Complaints*:

http://www.deq.state.id.us/about/policies/pm00_6.cfm

Local officials and the public should be included as part of site selection considerations. Realizing the possible health and nuisance impacts a land-applied wastewater facility can create, public awareness may help determine what may or may not be acceptable. Trying to correct a problem after the fact can be very time consuming and costly.

2.4.2 Nuisance Conditions

Typically, the goal of every WLAP permittee is to avoid nuisance conditions. The most effective way to do this is to prevent them from occurring. The permittee can initiate its own nuisance prevention program for odors, vectors, insects and other nuisance conditions through: (1) equipment design, i.e. designing drainage of all transfer lines to prevent wastewater turning anaerobic; (2) follow through on operation and maintenance that includes management of probable or potential nuisance conditions; (3) proactive

company outreach to adjacent property owners and/or immediate community to inform them about the facility and wastewater-land application system. Effective outreach may consist of, offering a tour of the facility, or asking the community for its input to jointly resolve a potential nuisance condition before it becomes a reality. One real life solution to an ongoing nuisance situation by a community occurred after an industry officer was elected to city council and saw their company in the eyes of the whole community.

In addition to what the permittee might choose to voluntarily do, Idaho law provides direction in regard to nuisance conditions. The Idaho State Constitution and Idaho Code recognize four types of nuisance conditions: private, public, general and public health. Prevention and resolution of nuisance conditions by law are based on:

(1) *Local (city/county) laws or ordinances regarding general, public, or public health based nuisances*.
This means that any county law(s) or ordinance(s) pertaining to nuisances that exist may become a condition of the local P&Z permit or building permit issued to a WLAP facility. The local city or county should direct any resolution efforts on city/county laws or ordinances.

(2) *The Idaho State Constitution and Idaho Code*
The constitution and code provides cities and counties with the authority to take necessary steps to protect the public health, safety and general welfare of citizens within their jurisdictions. As such, abatement of general or public nuisances may also be resolved by a local city or county.

Idaho Code distinguishes between public "health" nuisances and general or public nuisances, granting authority to the district health departments to abate public "health" nuisances.

(3) *Compliance With Required Permit Conditions*
Prevention and resolution of nuisance conditions may be a condition of a license or permit. Compliance with required permit conditions is addressed by the agency with permitting authority such as the Department of Water Resources for drilling a well or DEQ for an air quality permit or a WLAP permit. One example of language used to address potential nuisance conditions in a WLAP permit follows:

"Wastewater must not create a public health hazard or nuisance condition as stated in IDAPA Section 16.01,2600,03. In order to prevent public health hazards and nuisance conditions the permittee shall:

a. Apply wastewater as evenly as practicable to the entire treatment area;

b. Prevent organic solids (contained in the wastewater) from accumulating on the ground surface to the point where the solids putrefy or support vectors or insects; and

c. Prevent wastewater from ponding in the fields to the point where the ponded wastewater putrefies or supports vectors or insects."

2.5 References

General Soil Maps for Idaho, 1984

Soil Survey Staff. 1975. Soil Taxonomy. U.S. Dept. Agr. Handboook No. 436. U.S. Govt. Printing Office, Washington.

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3. Not Used at This Time

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